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§ 226. **A Nostoc the Matrix of Scytonema.**—Among the fresh water Algæ there is a genus *Nostoc*, embracing about seventy species described by European and American authors. A *Nostoc* is a gelatinous sack (thallus), more or less firm, usually sub-globose, filled with watery endochrome in which are embedded moniliform filaments. *Nostocs* vary in size; some do not exceed the diameter of a human hair, others are of the size and form of peas and cherries; some are indefinitely expanded. They are found on dripping rocks, in pools and springs, on the ground, on trunks of trees, old wood, etc. The *Nostoc* has generally been considered a perfect plant. Dr. Itzigsohn, Professor J. Sachs and J. Baranetzky, however, have looked upon it as of doubtful character, and thought they traced a relation between one form, *Nostoc commune*, and the lichen genus *Collema*. Other authors, however, do not consider their position tenable.

A careful study of a number of forms has led me to the conviction that *Nostocs* are not perfected plants, and, reasoning from analogy, I would call them the matrices of *Scytonema*. I believe the many forms of the large genus *Scytonema* are all evolved from them.

For illustration of the general principle I take several forms. The one that first elicited my attention was collected in Florida, by H. W. Ravenel, from the bark of a Cypress tree. The plant evolved from it, *Scytonema mirabile*, n. sp. is very distinct in the so called twinned pseudo-branches, and, hence, particularly suited for tracing the various stages of development.

Having reference to the plate, figs. A, A, represent two small matrices (*nostocs*) in their normal character. B, another form, in which the filaments, which possess an *Oscillaria*-like power of movement, have arranged themselves in sub-parallel order. C, an older form, partially faded, and apparently diffuent. Many do really die and pass off in this manner, but here and there one comes to maturity and evidences by faint outlines the developing forms of the true plant. These are vermiform figures nestled together in the matrix, (C). When at full maturity for delivery, the matrix breaks and the young plants escape; these are usually more or less fusi-form (E, E,) thin, membranous, with but a slight indication of an internal filament. These forms are often so distinct from the matured plant, that they could not be identified except by tracing them from their origin to their full development. In the process of growth the young plants present many forms; F, the first stage of a twinned branch. G, H, J, J, are apparently more advanced growths. These may be faded forms of young plants, nevertheless they represent different stages of development. Fig. R is a perfected plant. The specific features are the frequent twinned pseudo-branches adhering, and usually without separation of the trichoma, at the end.

For my second illustration I take forms collected repeatedly during the past summer in this vicinity from dripping rocks; they are *Nostoc sphaeroides*, Ktz. and *Nostoc riparium*, Cessati. Among the larger forms in older condition, some are found in which the young, immatured filaments may be distinctly seen.

Kützinger, Agardh, Cessati and others describe Nostocs which have the filaments sometimes sheathed, not always, and usually indistinctly, "indistinctis vel diffluentibus." The descriptions given accord well with the appearances of these forms, (M). The process of development in some is not unlike the one before described. In others it is quite distinct. I had several matrices, which after having been kept in water eight or ten days, literally fell to pieces under slight pressure, and spread out a whole nest of young *Scytonema* filaments (W, W) linear, short, somewhat curved and membranous forms. These elongate into filaments, (V, V).

In other Matrices (N) the sheathed filaments break up into smaller parts, each of which forms a separate cell or sack, in which the cellules of the parts of the moniliform filaments divide and multiply. After a time the distended epidermis of the matrix breaks, and the young are scattered. These are usually subspherical (P) or oblong (Q) and often in series, two to six united, (P, Q). Each contains a single filament, more or less coiled. A heterocyst generally makes a link of union. In the process of development the filament uncoils and lengthens, the epidermis at first subspherical (P) elongates also (Q) and finally when the filament is straightened out (S, T) the epidermis is brought close to it, and thus constitutes the sheath of the trichoma, (T).

The young plants vary in size, and undeveloped they may easily be mistaken for distinct species. X, X are fully matured plants. Very young forms (Q, T) are occasionally observed to put forth the characteristic double pseudo-branches.

Nostocs of other forms, and particularly those of irregularly expanded thalli, develop the plants by a more simple process. The cellules of the moniliform filaments expand and unite; the walls of union are absorbed and thus a continuous filament is formed, which develops the true plant. Specimens of this kind occur among gatherings made at Niagara, and in this vicinity, but the most perfect were found among the extensive collections made by C. F. Austin and J. Donnell Smith during the past month of March in South Western Florida. In a small portion of the gelatinous mass of a matrix, no larger than to be visible under one-fifth objective, the various stages of development may be seen intermingled.

There is a form of a plant which I often found difficult to separate from the true *Scytonema* because it is so much like it, but sometimes in part, assumes the *Tolypothrix* character. The life history is distinct and separates it readily.

Matrices appear to be of three kinds. The majority are sterile, others develop *Scytonema*, and a third class, apparently reproduces its like in the manner hitherto described by many authors.

Many details and peculiarities might be added, but the object of this article is not to present a full history, but simply to record facts for the benefit of those interested in this subject, and to aid in farther examinations. One thing more may be noticed, the circumstance that led to these investigations, that is, that Nostocs and *Scytonema* are usually found together, more or less intermingled, sometimes the one and sometimes the other predominating.

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